

More to give than just the div:

# *semantics*

and how to get them right

Hidde de Vries, Frontmania, Utrecht, 2022

# Hi, I'm Hidde

- blogger (hidde.blog)
- accessibility specialist
- developer relations







**Sanity.io**

Content management platform  
that is equally great for developers,  
content creators and businesses

# *semantics*

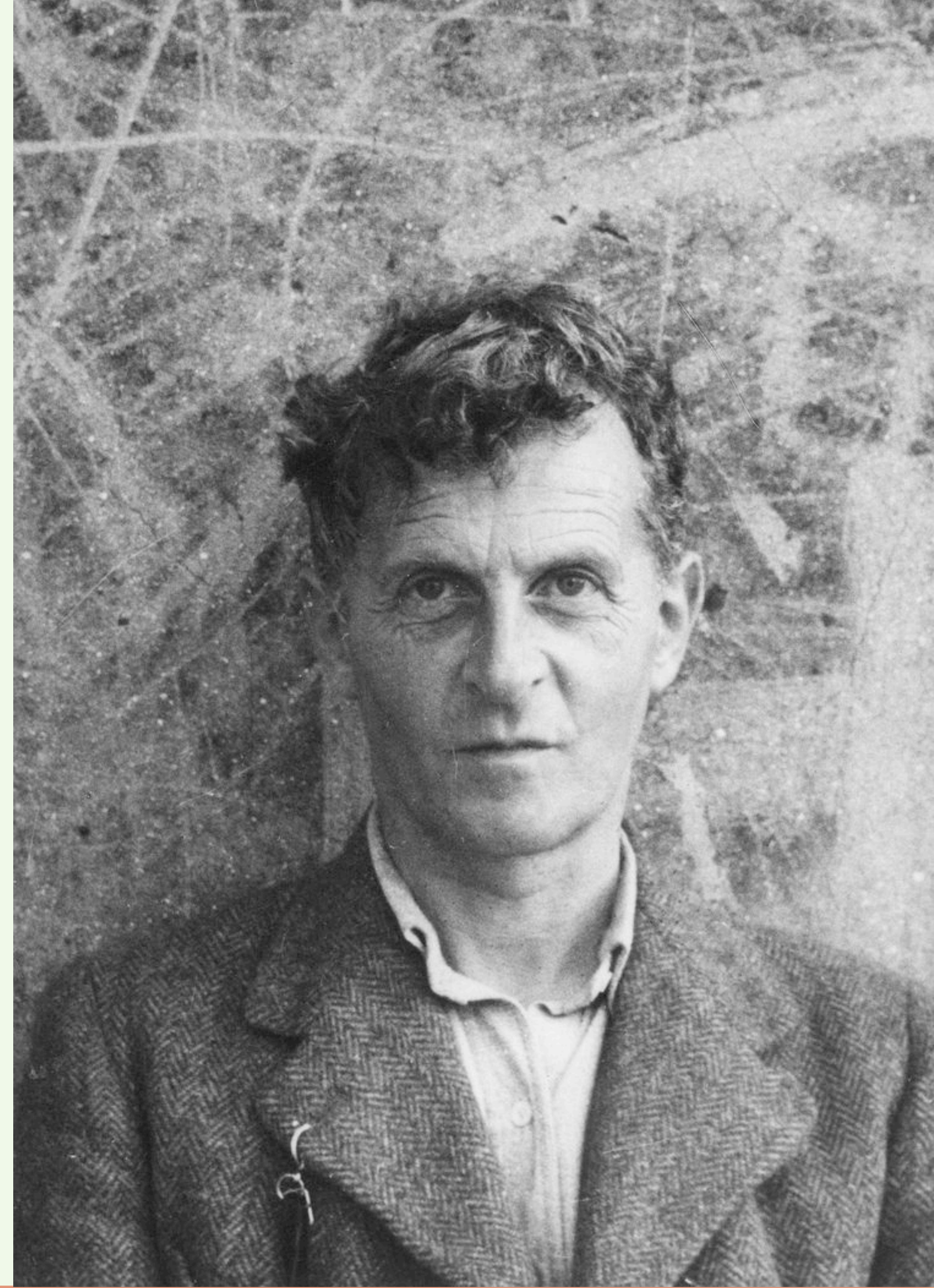


Correspondence  
theories of meaning



# Wittgenstein: “the meaning of a word is its use in the language”

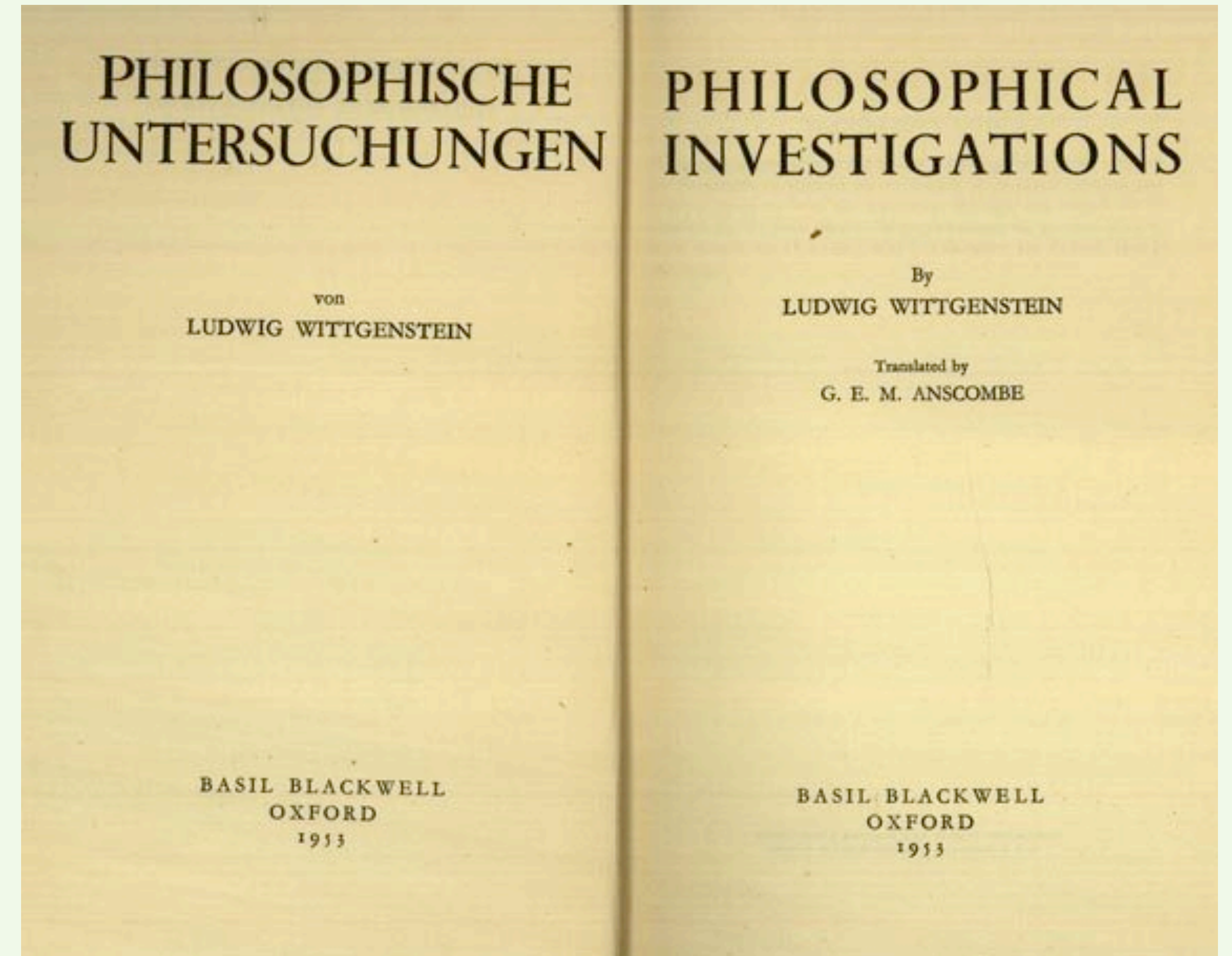
Ludwig Wittgenstein, *Philosophical Investigations* (1953)





Wittgenstein: no such thing as  
a **private language**, there can  
only be meaning if it's shared

Ludwig Wittgenstein, *Philosophical Investigations* (1953)



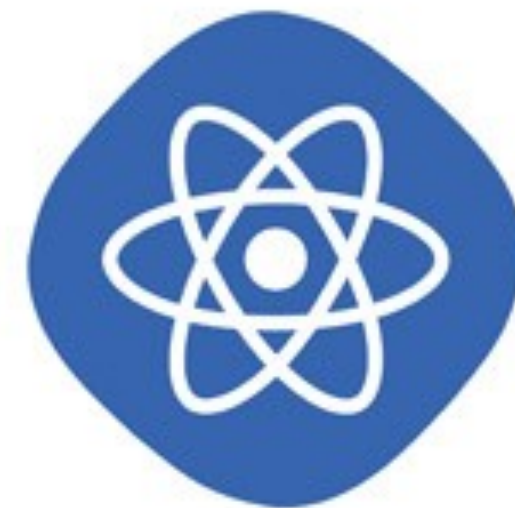
Your design system is  
a shared language.





Your API is a shared language.

Your Vue/Svelte/<custom-  
element> component names  
are a shared language.



Classification depends on  
place and culture





Classification is hard  
and AI aren't great at it

**KATE CRAWFORD**



**ATLAS OF AI**

# Semantics on the web

For the web, you could  
have a lot semantics...



```
<?xml version="1.0"?>
<purchaseOrder orderDate="1999-10-20">
  <shipTo country="US">
    <name>Alice Smith</name>
    <street>123 Maple Street</street>
    <city>Mill Valley</city>
    <state>CA</state>
    <zip>90952</zip>
  </shipTo>
  <billTo country="US">
    <name>Robert Smith</name>
    <street>8 Oak Avenue</street>
    <city>Old Town</city>
    <state>PA</state>
    <zip>95819</zip>
  </billTo>
  <comment>Hurry, my lawn is going wild<!/comment>
  <items>
    <item partNum="872-AA">
      <productName>Lawnmower</productName>
      <quantity>1</quantity>
      <USPrice>148.95</USPrice>
    </item>
  </items>
  <comment>...</comment>
```

... All rights reserved.

```
</xsd:documentation>
</xsd:annotation>

<xsd:element name="purchaseOrder" type="PurchaseOrderType"/>
<xsd:element name="comment" type="xsd:string"/>

<xsd:complexType name="PurchaseOrderType">
  <xsd:sequence>
    <xsd:element name="shipTo" type="USAddress"/>
    <xsd:element name="billTo" type="USAddress"/>
    <xsd:element ref="comment" minOccurs="0"/>
    <xsd:element name="items" type="Items"/>
  </xsd:sequence>
  <xsd:attribute name="orderDate" type="xsd:date"/>
</xsd:complexType>

<xsd:complexType name="USAddress">
  <xsd:sequence>
    <xsd:element name="name" type="xsd:string"/>
    <xsd:element name="street" type="xsd:string"/>
    <xsd:element name="city" type="xsd:string"/>
    <xsd:element name="state" type="xsd:string"/>
    <xsd:element name="zip" type="xsd:decimal"/>
  </xsd:sequence>
</xsd:complexType>
```

...but for accessibility,  
we need one,  
agreed-upon set

HTML is a standard way for your website to declare its semantics

HTML is not a way to declare  
what stuff **looks like** on a page



It's a way to declare  
what stuff **is** on a page

HTML semantics are  
**not** behaviour, but are  
often tied to it



Multi device web

# HTML enables...



**This NeXT machine was used  
to develop and run the first  
WWW server, multimedia  
browser and web editor**







Multi device web

# HTML enables...





Multi device web

**Heading 1**

**Heading 2**

Content

Default stylesheets

# HTML enables...



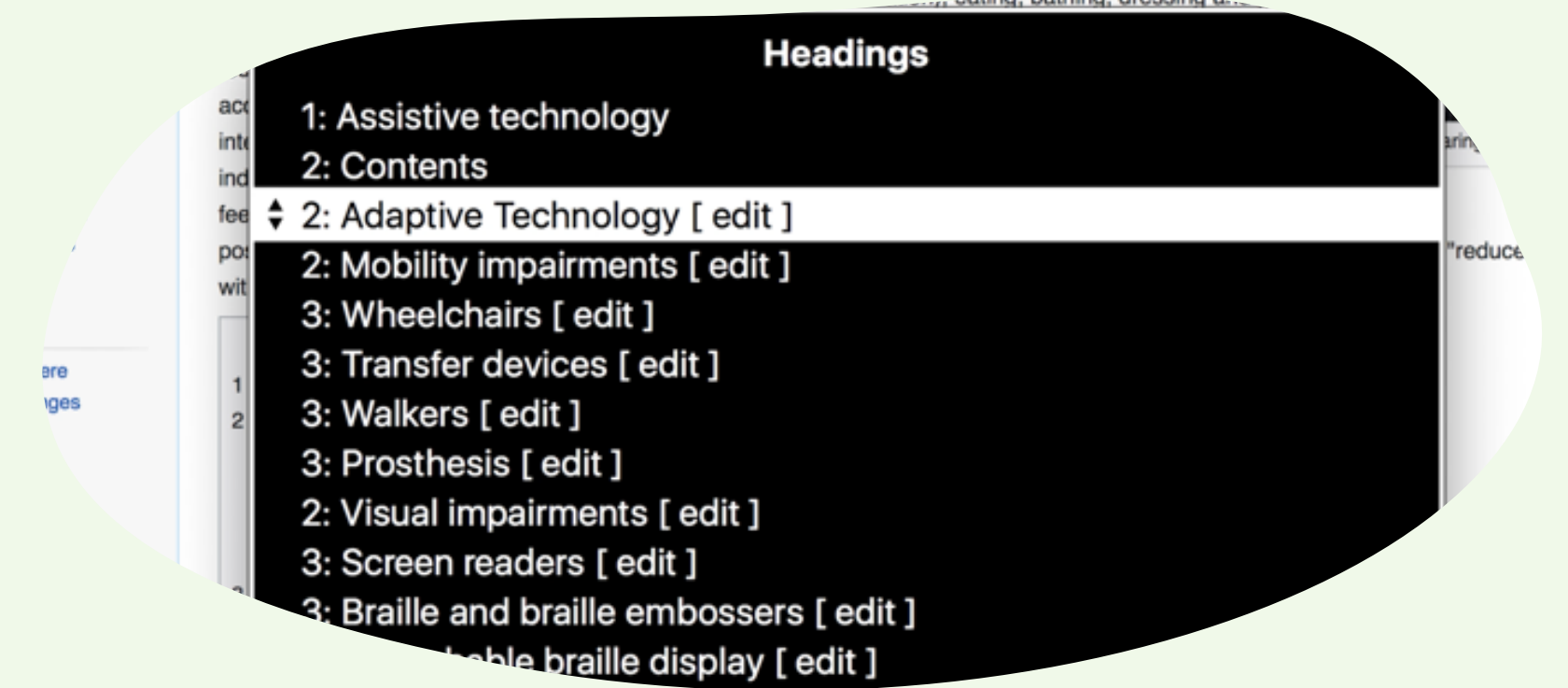
Multi device web

**Heading 1**

**Heading 2**

Content

Default stylesheets



‘Browse by heading’

# HTML enables...





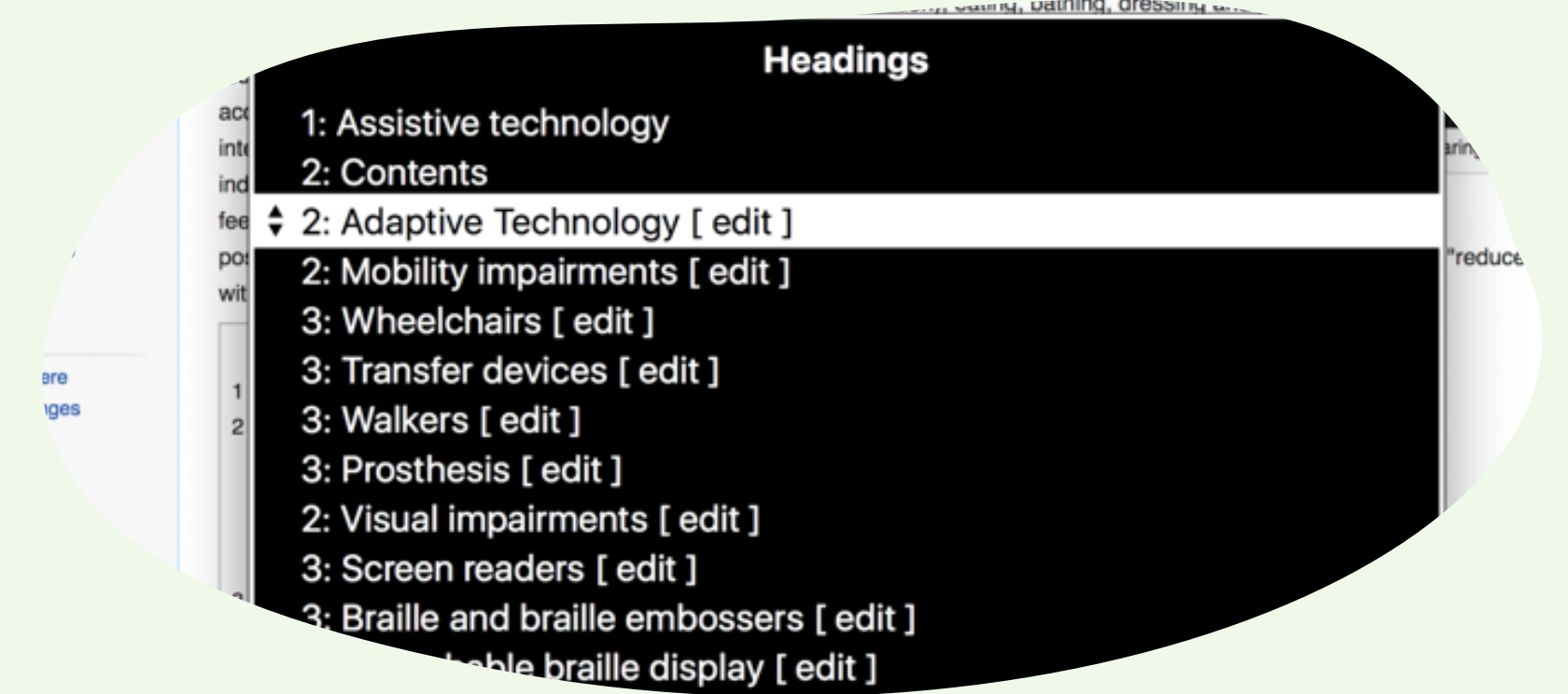
Multi device web

Heading 1

Heading 2

Content

Default stylesheets



‘Browse by heading’

# HTML enables...

Default behaviour

Cook rice



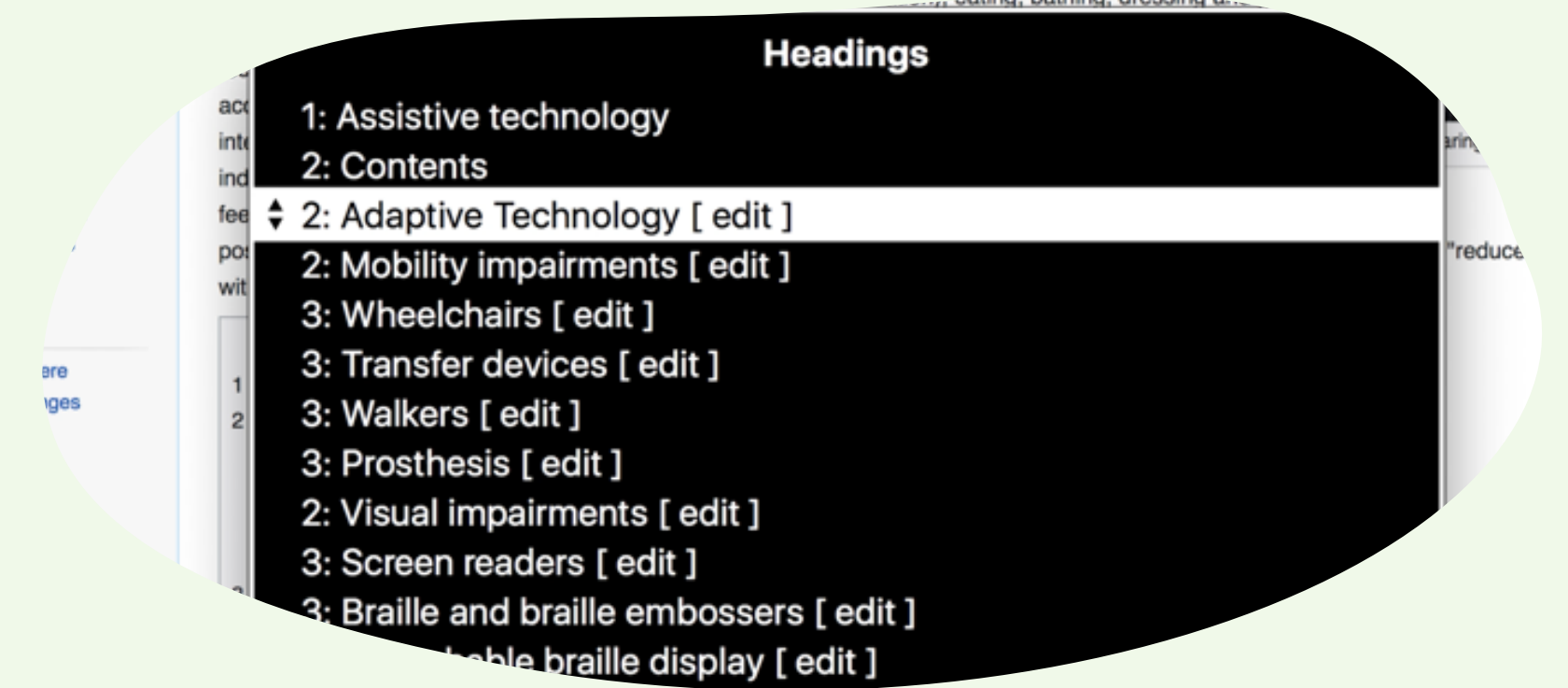
Multi device web

Heading 1

Heading 2

Content

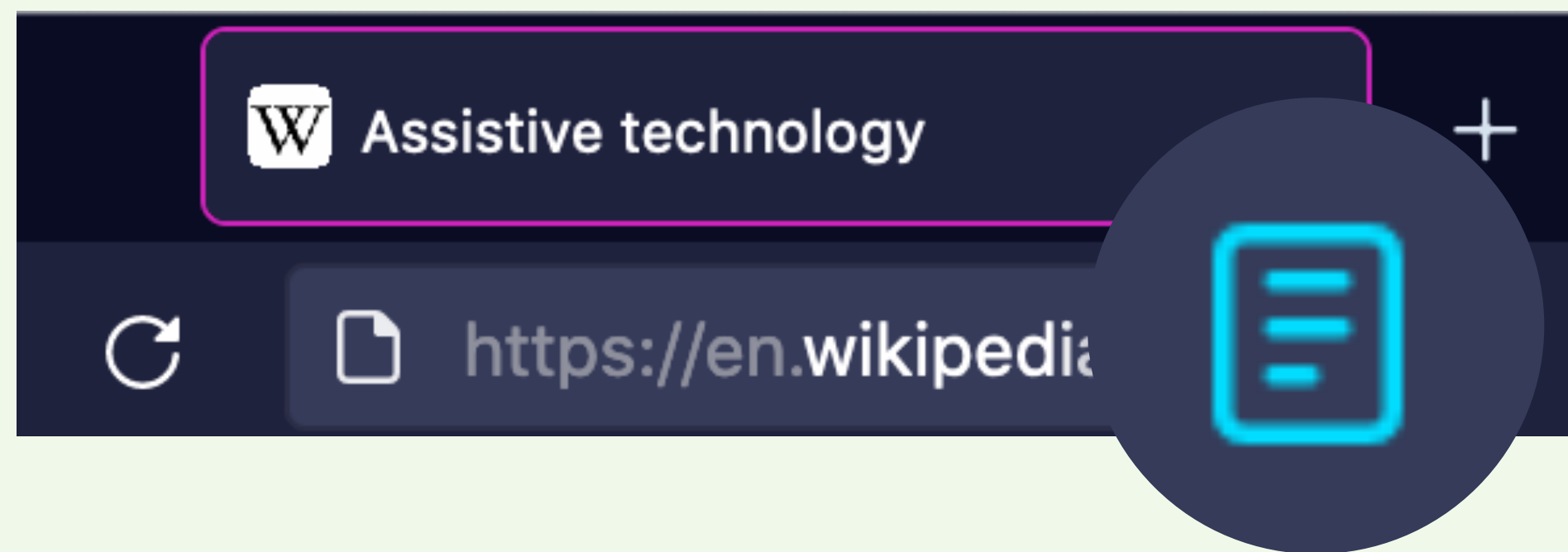
Default stylesheets



'Browse by heading'

# HTML enables...

Reader mode



Default behaviour

Cook rice

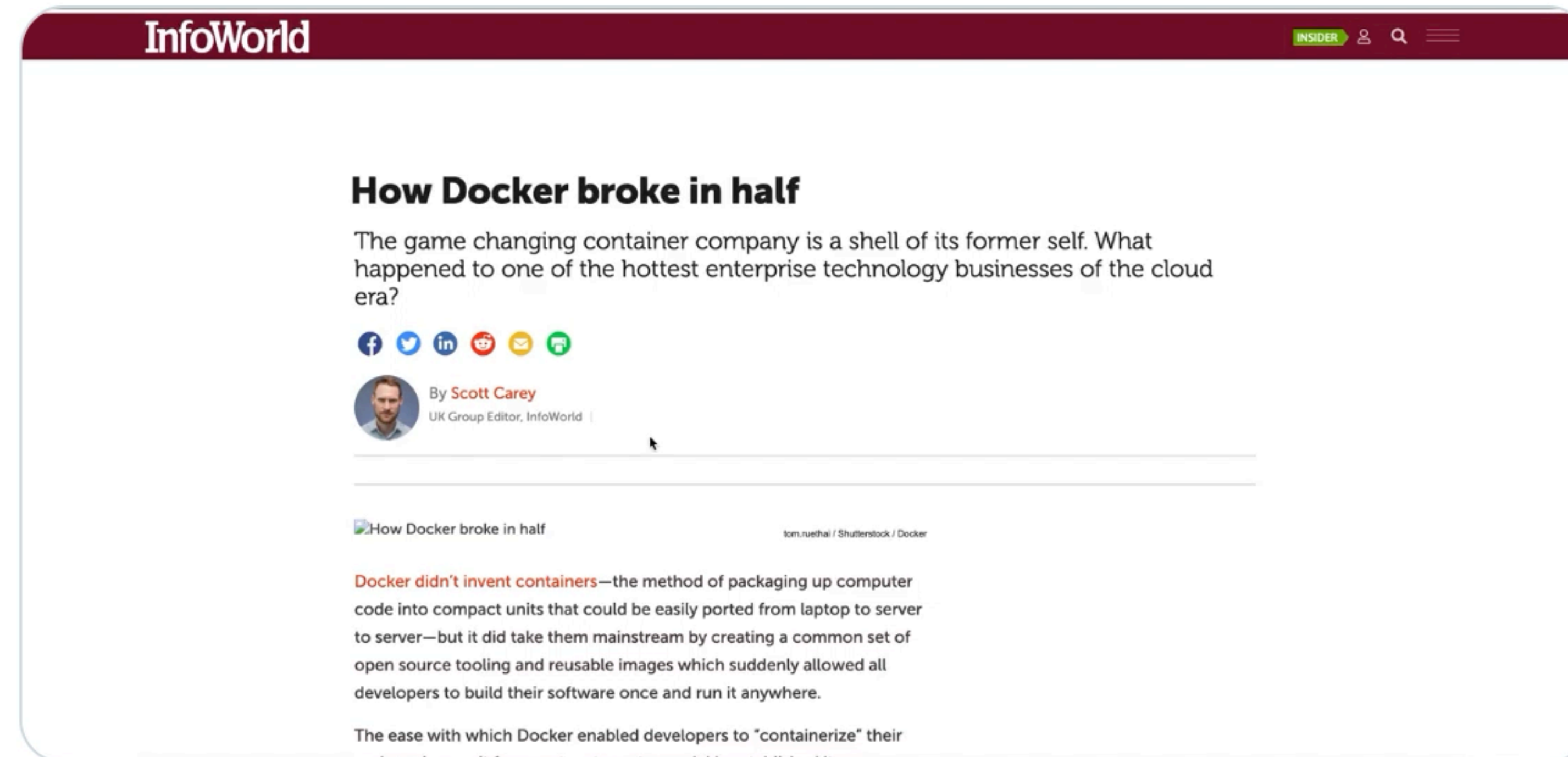




Andrej Karpathy ✓  
@karpathy



## Browsing the web, 2021



6:47 AM · Sep 9, 2021 · Twitter Web App





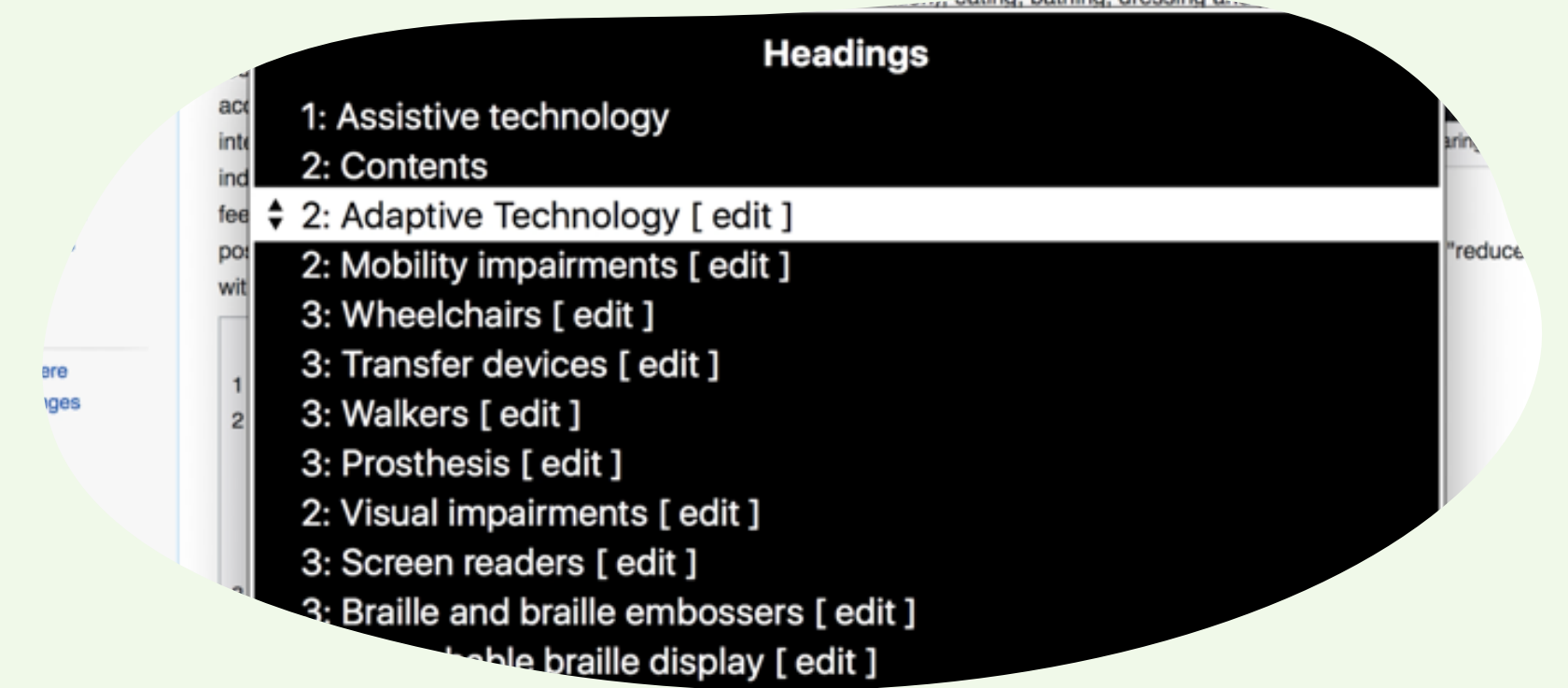
Multi device web

Heading 1

Heading 2

Content

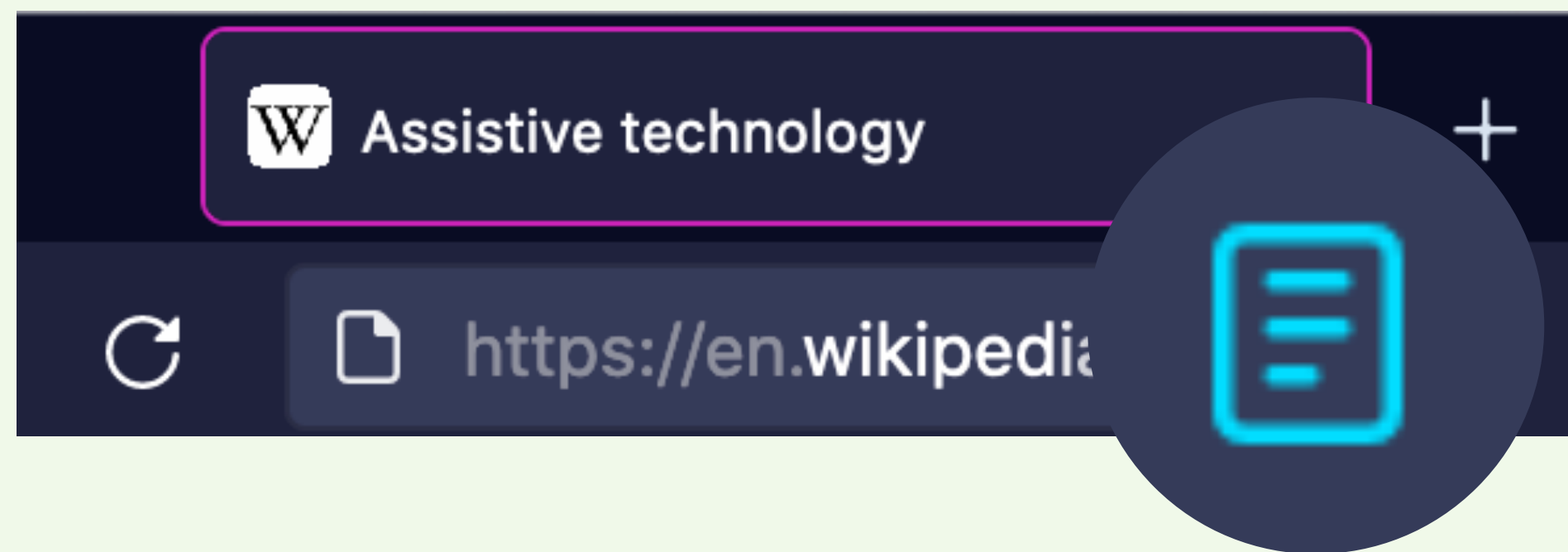
Default stylesheets



'Browse by heading'

# HTML enables...

Reader mode



Default behaviour

Cook rice

HTML points machines  
at what stuff is

HTML points assistive  
technology at what stuff is



Hire for HTML expertise



# In practice

Semantics in HTML is in  
<element>

Semantics in HTML is in  
<element attribute>

Semantics in HTML is in

`<element attribute="value">`

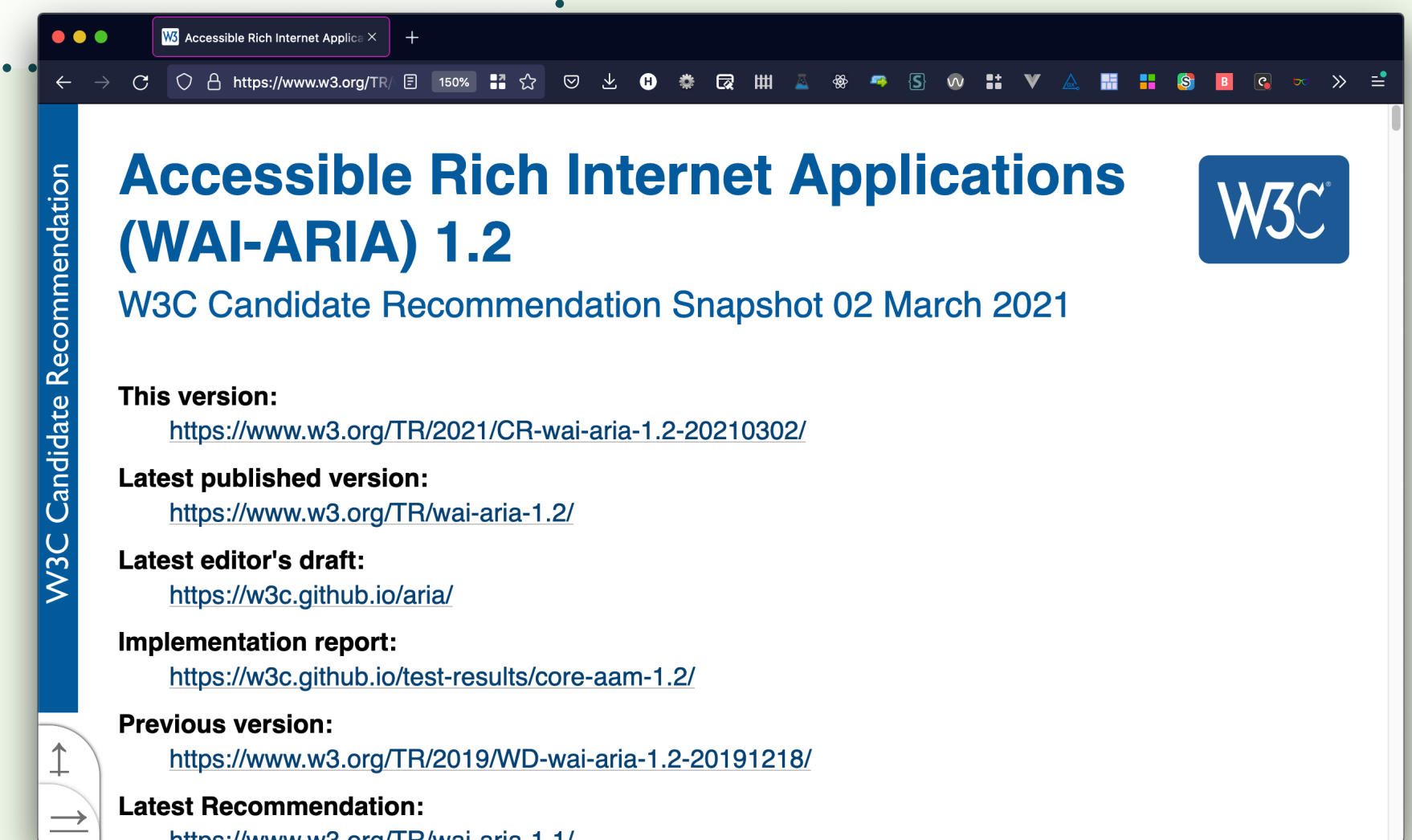


# WAI-ARIA defines semantics beyond HTML

“

WAI-ARIA is designed to provide semantic information about objects when host languages lack native semantics [...]

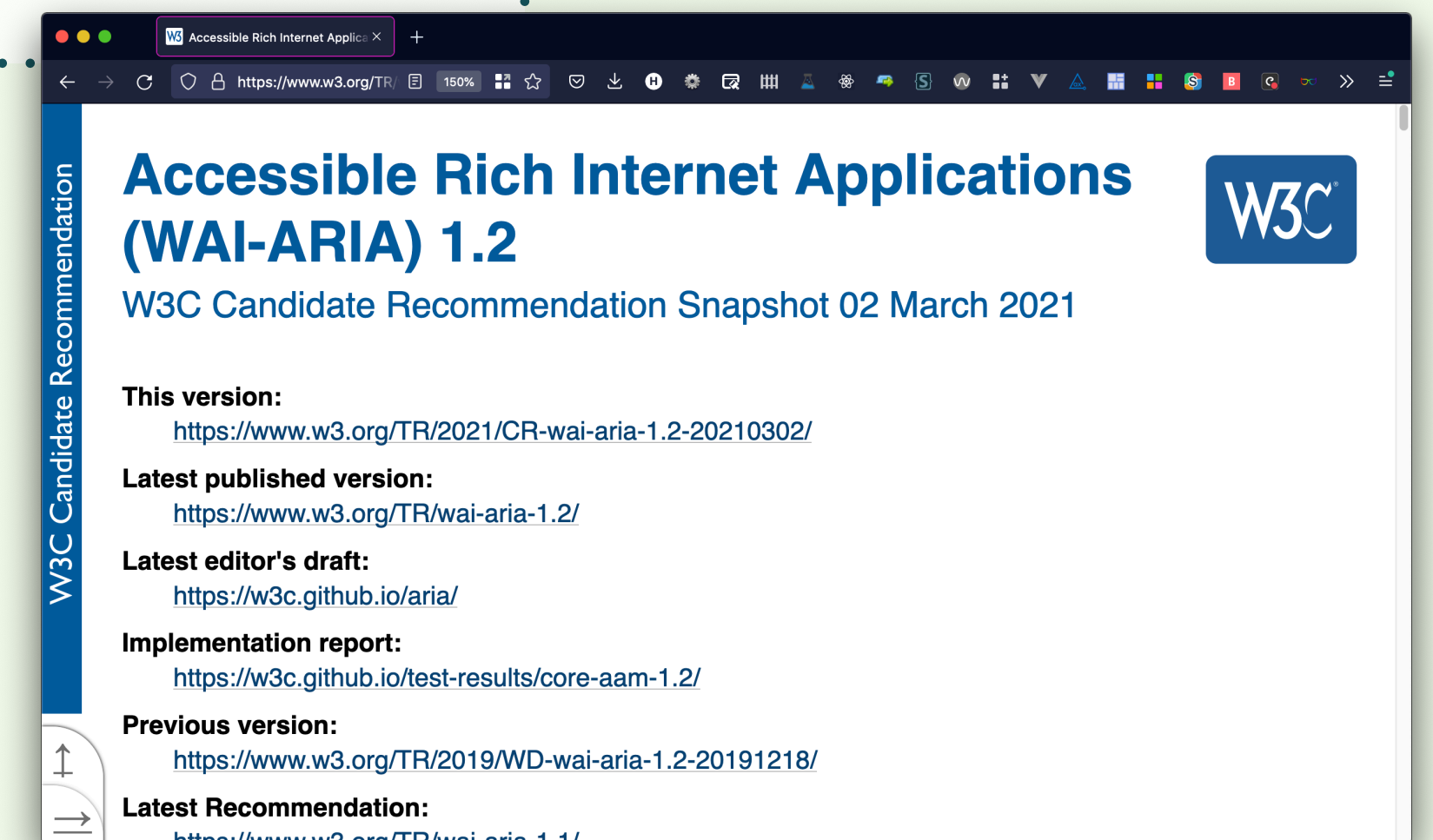
Accessible Rich Internet Applications (WAI-ARIA) 1.2, §8.4



“

host languages [...] can evolve and provide new native features that correspond to WAI-ARIA features [so] there are many situations in which WAI-ARIA semantics are redundant

Accessible Rich Internet Applications (WAI-ARIA) 1.2, §8.4



# Multiple ways to get to one semantic

`<button>`

Semantic HTML element

`<div role="button">`

Semanticless HTML element with WAI-ARIA role for semantics



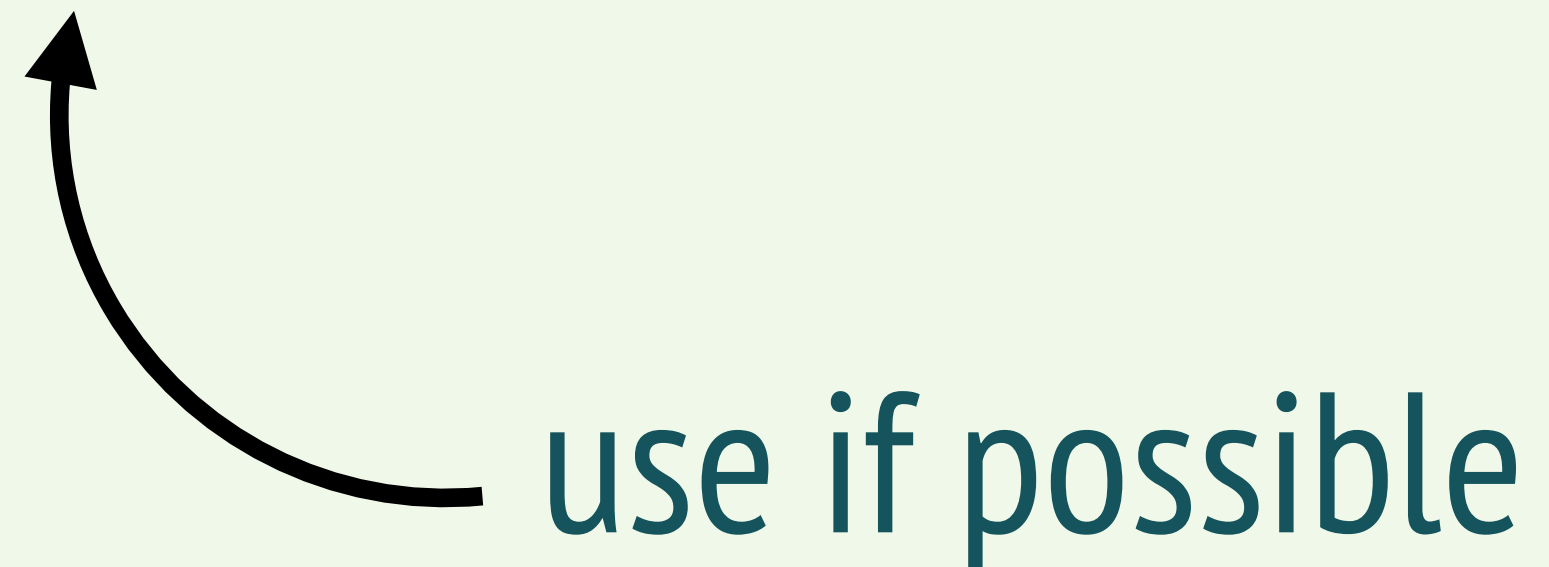
# Multiple ways to get to one semantic

`<button>`

Semantic HTML element

`<div role="button">`

Semanticless HTML element with WAI-ARIA role for semantics



# Speaking of buttons...



**Cory LaViska**  
@claviska



Unpopular opinion: in a design system, a "link" and a "button" should be one component.

10:01 PM · Oct 5, 2021 · Twitter Web App

**Products**

**Add to cart**

**Products**

**Add to cart**

the right semantics:  
the right HTML  
element\* in the DOM

\*or: the right role



## George Harrison

# US is reopening its borders to global epicenter of Covid-19



## The country ends a 20-month travel ban at the same moment Europe is battling a surge in cases

## Global Covid-19 cases surpass 250 million



# Obama takes swipe at Trump over 'active hostility' on climate

- See an ethical farm with 6,000 chickens
- Fossil fuel lobbyists outnumber any single country at COP26
- Minister stands in suit and tie in sea to speak



## CIA Director had rare conversation with Putin

## Sierra Leone tanker blast deaths rise to 115

## US seizes \$6 million in ransom payments

### Analysis: Biden basks after huge victory

**Analysis:** Nancy Pelosi is the most effective speaker ever

## Gay footballer says he would be 'scared' to play at 2022 World Cup in Qatar

## Bodies of three missing French climbers recovered in Himalayas

Ethiopia appears to be detaining people 'based on ethnicity,' commission warns

Crime scene technician testifies in trial of men charged with killing Ahmaud Arbery







CNN International - Breaking News

https://edition.cnn.com

CNN

World

US Politics

Business

Health

Entertainment

Style

Travel

Sports

Videos

Edition

NEW PODCAST: Tug of war over US vaccine


Valu minister

Obama speech

US reopens


George Harrison

US is reopening borders to global epicenter of Covid-19




The country ends a 20-month travel ban at the same moment Europe is battling a surge in cases

Global Covid-19 cases surpass 250 million



Obama takes swipe at Trump over 'active hostility' on climate

- See an ethical farm with 6,000 chickens
- Fossil fuel lobbyists outnumber any single country at COP26
- Minister stands in suit and tie in sea to speak



CIA Director had rare conversation with Putin

Sierra Leone tanker blast deaths rise to 115

US seizes \$6 million in ransom payments

**Analysis:** Biden basks after huge victory

**Analysis:** Nancy Pelosi is the most effective speaker ever

Gay footballer says he would be 'scared' to play at 2022 World Cup in Qatar

Bodies of three missing French climbers recovered in Himalayas

Ethiopia appears to be detaining people 'based on ethnicity,' commission warns

Crime scene technician testifies in trial of men charged with killing Ahmaud Arbery

role: link

@hdv



CNN International - Breaking News

← → ↺ 🔒 https://edition.cnn.com 🗪 ☆ 📧 ⬇️ Ⓜ️ ⚙️ 📝 📊 🧪 ⚗️ 📶 📄 📅 📶 📄 📅 🔍 📶 📄 📅


CNN

World US Politics **Business** Health Entertainment Style Travel Sports Videos

Edition 🔍 ☰

NEW PODCAST: Tug of war | COVID-19: Vaccination tracker | TRENDING: Astroworld tragedy | Tuvalu minister | Obama speech | US reopens | George Harrison


# US is reopening its borders to global epicenter of Covid-19



**The country ends a 20-month travel ban at the same moment Europe is battling a surge in cases**


Global Covid-19 cases surpass 250 million

## role: link



**Obama takes swipe at Trump over 'active hostility' on climate**

- See an ethical farm with 6,000 chickens
- Fossil fuel lobbyists outnumber any single country at COP26
- Minister stands in suit and tie in sea to speak



### CIA Director had rare conversation with Putin

Sierra Leone tanker blast deaths rise to 115

US seizes \$6 million in ransom payments

**Analysis:** Biden basks after huge victory

**Analysis:** Nancy Pelosi is the most effective speaker ever

Gay footballer says he would be 'scared' to play at 2022 World Cup in Qatar

Bodies of three missing French climbers recovered in Himalayas

Ethiopia appears to be detaining people 'based on ethnicity,' commission warns

Crime scene technician testifies in trial of men charged with killing Ahmaud Arbery



CNN International - Breaking News

https://edition.cnn.com

CNN

WorldUS PoliticsBusinessHealthEntertainmentStyleTravelSportsVideos

Edition

NEW PODCAST: Tug of war

COVID-19: Vaccination tracker

TRENDING: Astroworld tragedy


Tuvalu minister

Obama speech

US reopens


George Harrison

US is reopening its borders to global epicenter of Covid-19



The country ends a 20-month travel ban at the same moment Europe is battling a surge in cases

Global Covid-19 cases surpass 250 million




Obama takes swipe at Trump over 'active hostility' on climate

• See an ethical farm with 6,000 chickens

• Fossil fuel lobbyists outnumber any single country at COP26

• Minister stands in suit and tie in sea to speak



Director had rare conversation with Putin

Sierra Leone tanker blast deaths rise to 115

US seizes \$6 million in ransom payments

Analysis: Biden basks after huge victory

Analysis: Nancy Pelosi is the most effective speaker ever

Gay footballer says he would be 'scared' to play at 2022 World Cup in Qatar

Bodies of three missing French climbers recovered in Himalayas

Ethiopia appears to be detaining people 'based on ethnicity,' commission warns

Crime scene technician testifies in trial of men charged with killing Ahmaud Arbery

role: button

@hdv



CNN International - Breaking News


https://edition.cnn.com

CNN

WorldUS PoliticsBusinessHealthEntertainmentStyleTravelSportsVideos

Edition

News and buzz



### A decades-long photography series about girlhood takes a tragic turn

China tightens grip on outspoken CEOs


Goldman Sachs: Inflation will likely get worse before it gets better

Short squeezes are pushing these stocks to the moon


▶

 Author claims news organizations are in 'woke stranglehold'

Featured




### What you need to know before traveling to the US




Archaeologists unearth 'slaves' room' at Pompeii

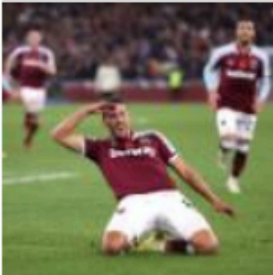
Spotlight



**Analysis:** Xi is rewriting history. But it's the future he wants to leave his mark on



Max Verstappen wins Mexican Grand Prix ahead of Lewis Hamilton as he edges towards F1 title



West Ham topple Liverpool's unbeaten run in five-goal thriller

@hdv



CNN International - Breaking Ne X


https://edition.cnn.com

CNN

WorldUS PoliticsBusinessHealthEntertainmentStyleTravelSportsVideos

Edition

News and buzz



A decades-long p  
series about girlh  
tragic turn


China tightens grip on outspoken CEOs

Goldman Sachs: Inflation will likely get worse before it gets better


Short squeezes are pushing these stocks to the moon

Author claims news organizations are in 'woke stranglehold'

Featured




What you need to know before traveling to the US




Archaeologists unearth 'slaves' room' at Pompeii


Spotlight



Analysis: Xi is rewriting history. But it's the future he wants to leave his mark on



Max Verstappen wins Mexican Grand Prix ahead of Lewis Hamilton as he edges towards F1 title



West Ham topple Liverpool's unbeaten run in five-goal thriller

role: heading

@hdv



## George Harrison

NATHAN L'AMINE/BILIONBERG/GETTY IMAGES

📺 Video shows aftermath of assassination



Key questions for your design system

Can it **output** the right semantics? Does it **encourage** the right semantics in docs?

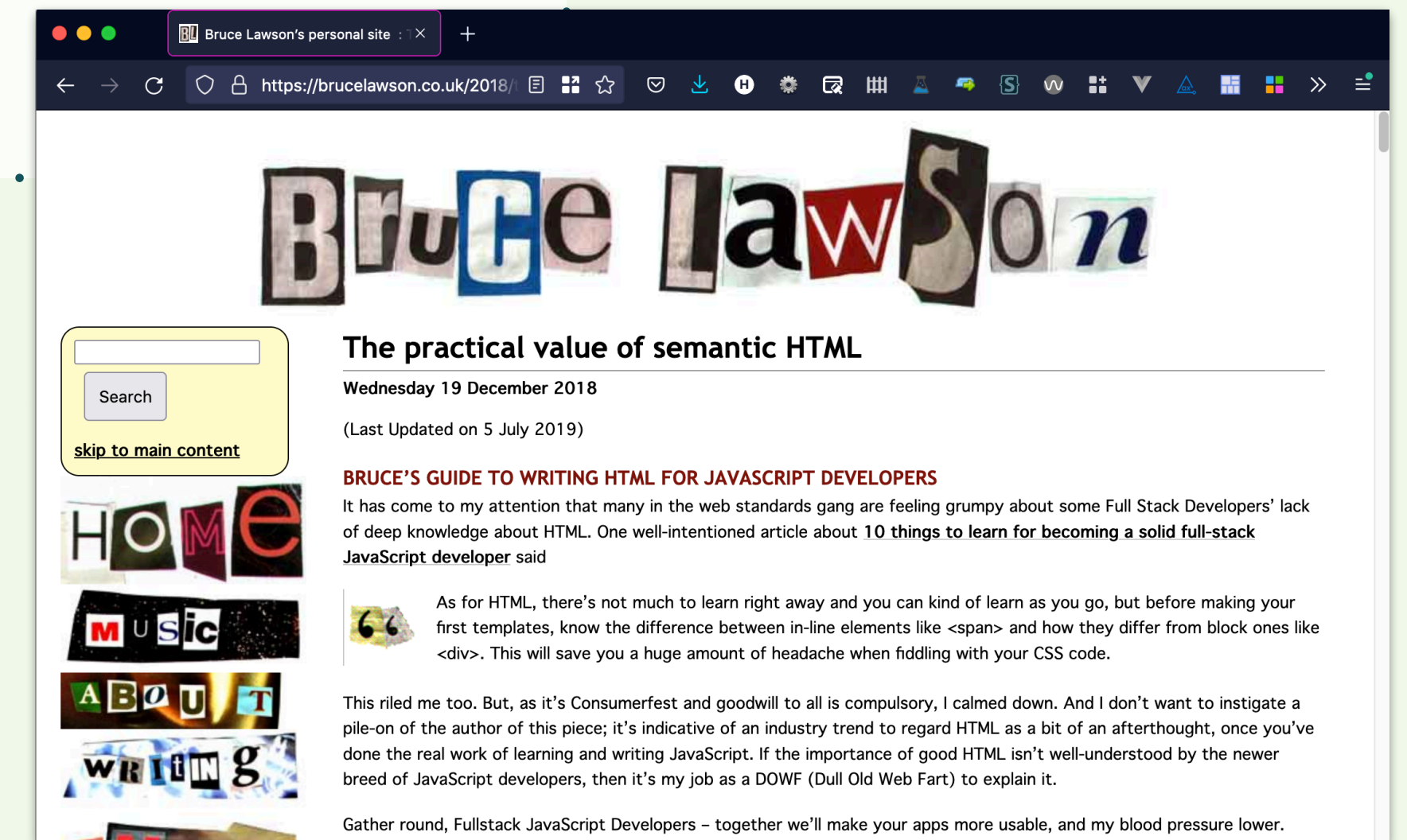


**meaning = use**

“

(...) semantic HTML, a posh term for choosing the right HTML element for the content. This isn't a philosophical exercise; it has **directly observable practical benefits**.

Bruce Lawson, “The practical value of semantic HTML”



If you use <h1>, <h2>, <h3>..., people can:

- see headings in reader mode
- navigate by heading

The screenshot shows a Wikipedia article titled "Assistive technology". The page is in reader mode, displaying a list of headings on the right side. The headings are as follows:

- 1: Assistive technology
- 2: Contents
- 2: Adaptive Technology [ edit ]
- 2: Mobility impairments [ edit ]
- 3: Wheelchairs [ edit ]
- 3: Transfer devices [ edit ]
- 3: Walkers [ edit ]
- 3: Prosthesis [ edit ]
- 2: Visual impairments [ edit ]
- 3: Screen readers [ edit ]
- 3: Braille and braille embossers [ edit ]
- 3: Refreshable braille display [ edit ]
- 3: Desktop video magnifier [ edit ]
- 3: Screen magnification software [ edit ]
- 3: Large-print and tactile keyboards [ edit ]
- 4: Personal emergency response systems
- 5: Accessibility software
- 6: Hearing impairments



open-borders.pages — Edited

View163%

InsertTableChartTextShapeMediaCommentCollaborateFormatDocument

Table of ContentsText

Select paragraph styles whose text will appear in the table of contents:

Paragraph Styles	#'s
<input type="checkbox"/> Body	<input checked="" type="checkbox"/>
<input type="checkbox"/> Blockquote	<input checked="" type="checkbox"/>
<input type="checkbox"/> Bibliography entry	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Header 3	
<input type="checkbox"/> Header 1	
<input checked="" type="checkbox"/> Header 2	
<input type="checkbox"/> Header & Footer	
<input type="checkbox"/> Footnote 1	

Range

Entire Document

Body

Paragraph Styles

Title

Subtitle

Heading

Heading 2

Heading 3

Heading Red

☒ Body

CAPTION

Header & Footer

Footnote

1. Introduction4

Structure5

The debate: closed borders versus open borders5

Who wants to cross borders?7

Perspective7

2. The case for closed borders9

The right to self-determination9

The freedom of association argument10

Preservation of culture12

Associative ownership14

Summary17

3. The case for open borders18

Carens' case for open borders18

All humans are equal21

Applicability of democratic justification22

Emigration requires immigration24

Multiculturalism25

Summary26

4. The feasibility of open borders28

The political reality28



# If you use `<button>`, people can:

- find it in the TAB order
- press it with just a keyboard
- submit the form, even if your JavaScript failed

If you use `<ol>`, `<ul>` or `<dl>`, people can:

- Hear it's a list and with how many items
- Still see it's a list in reader mode

# If you use autoComplete on inputs, users can:

- Tell their browser to fill in data for them
- Assistive tech can announce input purpose
- Use plugins for personalisation, e.g. with icons



If you use `table` with a `caption`, this for headers and `scope` attributes for direction:

- Assistive tech can provide useful affordances to end users

The HTML spec  
is the place to find  
out how to use HTML

[developers.whatwg.org](https://developers.whatwg.org)



# HTML: The Living Standard

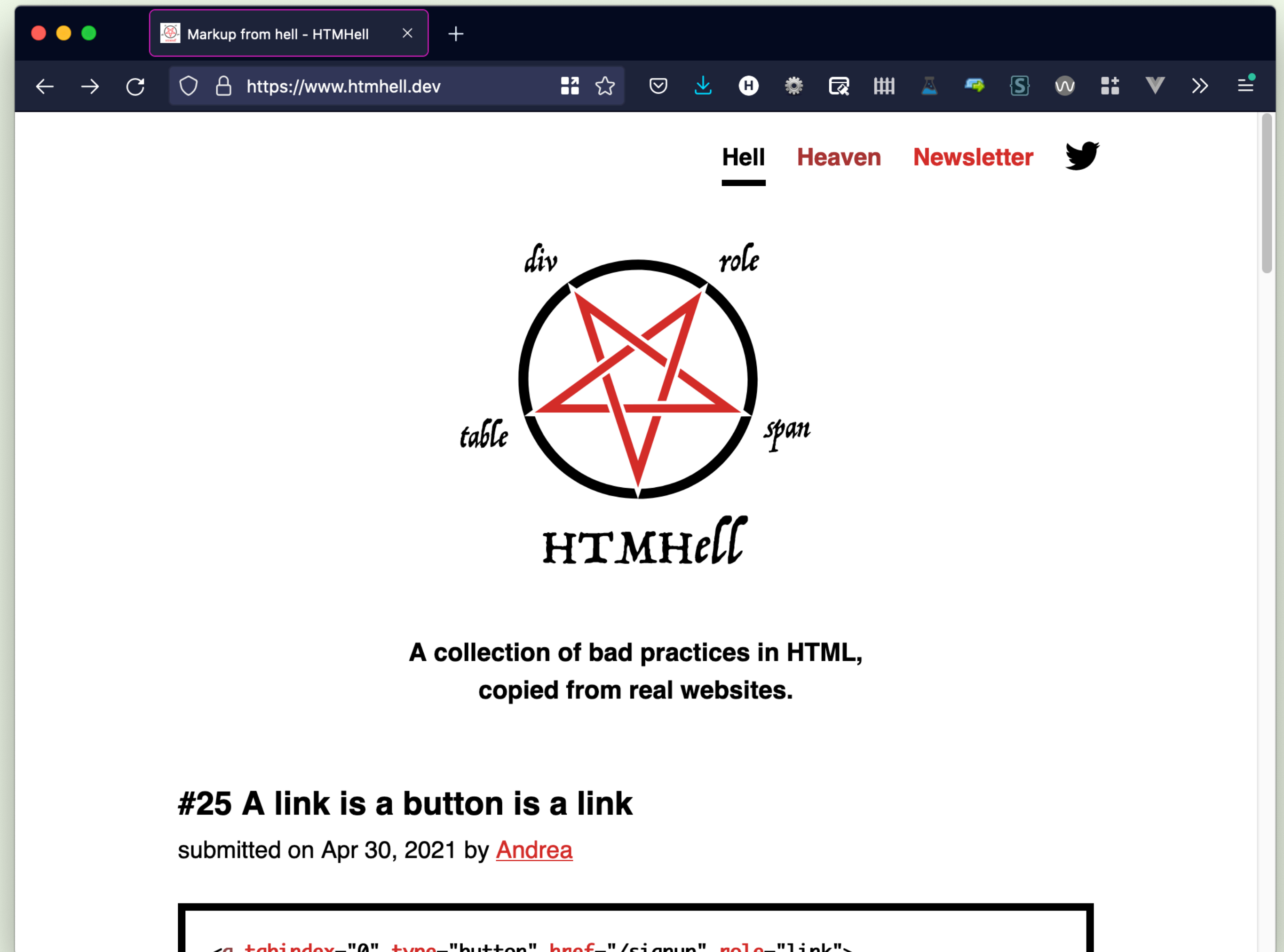
*Developer's Edition — Last Updated 18 September 2017*

Search. Press

## TABLE OF CONTENTS

- 1 [Introduction](#)
  - 1.1 [Is this HTML5?](#)
  - 1.2 [Background](#)
  - 1.3 [Audience](#)
  - 1.4 [Scope](#)
  - 1.5 [History](#)
  - 1.6 [Design notes](#)
  - 1.7 [HTML vs XML syntax](#)
  - 1.8 [Structure of this specification](#)
  - 1.9 [Privacy concerns](#)
  - 1.10 [A quick introduction to HTML](#)
  - 1.11 [Conformance requirements for authors](#)
  - 1.12 [Suggested reading](#)

# HTMHell collects examples of how **not** to use HTML





# Intentions vs reality

Sometimes, semantics are  
undone if you use specific CSS



# display overrides semantics

```
display: block;  
display: inline;  
display: grid;  
display: flex;  
display: contents;  
display: none;
```



## Safari / macOS 10.15.6

CSS	<table>, etc.	<ul>, <ol>, <dl>	<h#>	<button>
display: flex	✗ <sup>1</sup>	✓ <sup>4</sup>	✓	✓
display: grid	✗ <sup>1</sup>	✓ <sup>4</sup>	✓	✓
display: block	✗ <sup>2</sup>	✗	✓	✓
display: inline-block	✗ <sup>2</sup>	✗	✓	✓
display: contents	✗ <sup>3</sup>	✗	✗	✗

Lists can lose list semantics when you set `list-style-type: none` (in Safari)

- courgette
- feta
- basil
- garlic





25% KORTING



Oatly! Haverdrink Barista Edition

2.65  
**1.99**  
1 l



Valess Beefstyle burger  
Advertentie

**3.59**  
200 g



AH Amandel drink ongezoet

**1.65**  
1 l



**1.65**  
1 l



**1.79**  
1 l



**0.88**  
1 l



**James Craig**  (he/him)

@cookiecrook



Replying to [@pgrucza](#) [@rob\\_dodson](#) and 5 others

Correct. Check the test case linked in that Bugzilla tracker. Lististis on the Web was one of our biggest complaints from VoiceOver users prior to the heuristic change. FWIW, all browsers have similar heuristic checks for layout tables.

6:24 PM · Jan 12, 2019 · Twitter Web App





**James Craig** 🪡 (he/him) @cookiecrook · Jan 12, 2019



This decision was all about the users' experience on the majority of pages where web developers are not paying attention to the screen reader experience. Definitely open to change suggestions (including updating the heuristic) that make it better for authors w/o penalizing users.



4



1



3





Sometimes, semantics are undone  
when you nest unexpectedly

# Semantics in summary

```
<details>
  <summary>Ingredients</summary>
  <ul>
    <li>courgette</li>
    <li>peas</li>
    <li>basil</li>
    <li>feta</li>
  </ul>
</details>
```

► Ingredients

# Semantics in summary

```
<details open>
  <summary>Ingredients</summary>
  <ul>
    <li>courgette</li>
    <li>peas</li>
    <li>basil</li>
    <li>feta</li>
  </ul>
</details>
```

## ▼ Ingredients

- courgette
- peas
- basil
- feta



# Semantics in summary

```
<details>
  <summary>
    <h2>Ingredients</h2>
  </summary>
  <ul>
    <li>courgette</li>
    <li>peas</li>
    <li>basil</li>
    <li>feta</li>
  </ul>
</details>
```

## ▼ Ingredients

- courgette
- peas
- basil
- feta

# Semantics in summary

```
<details>
  <summary>
    <h2>Ingredients</h2>
  </summary>
  <ul>
    <li>courgette</li>
    <li>peas</li>
    <li>basil</li>
    <li>feta</li>
  </ul>
</details>
```

**Content model:**  
Phrasing content,  
optionally intermixed with  
heading content.

# Heuristics in the platform and assistive technologies



When you set `text-transform: uppercase`, some assistive technologies will read it like an abbreviation





Buy tickets

Your tickets

Stations and destinations

Travel information

Travelling with us

Help and support



# Christmas tickets on sale now

Book early and save for a fun-filled  
Christmas.

Book now

Book up to 7 January 2022 on selected routes

Buy tickets

Check your journey

Departing from...



Going to...



`::before / ::after`  
is included in accessible name calculation



# ::before / ::after is included in accessible name calculation

```
<button>Buy product</button>
```



Buy product

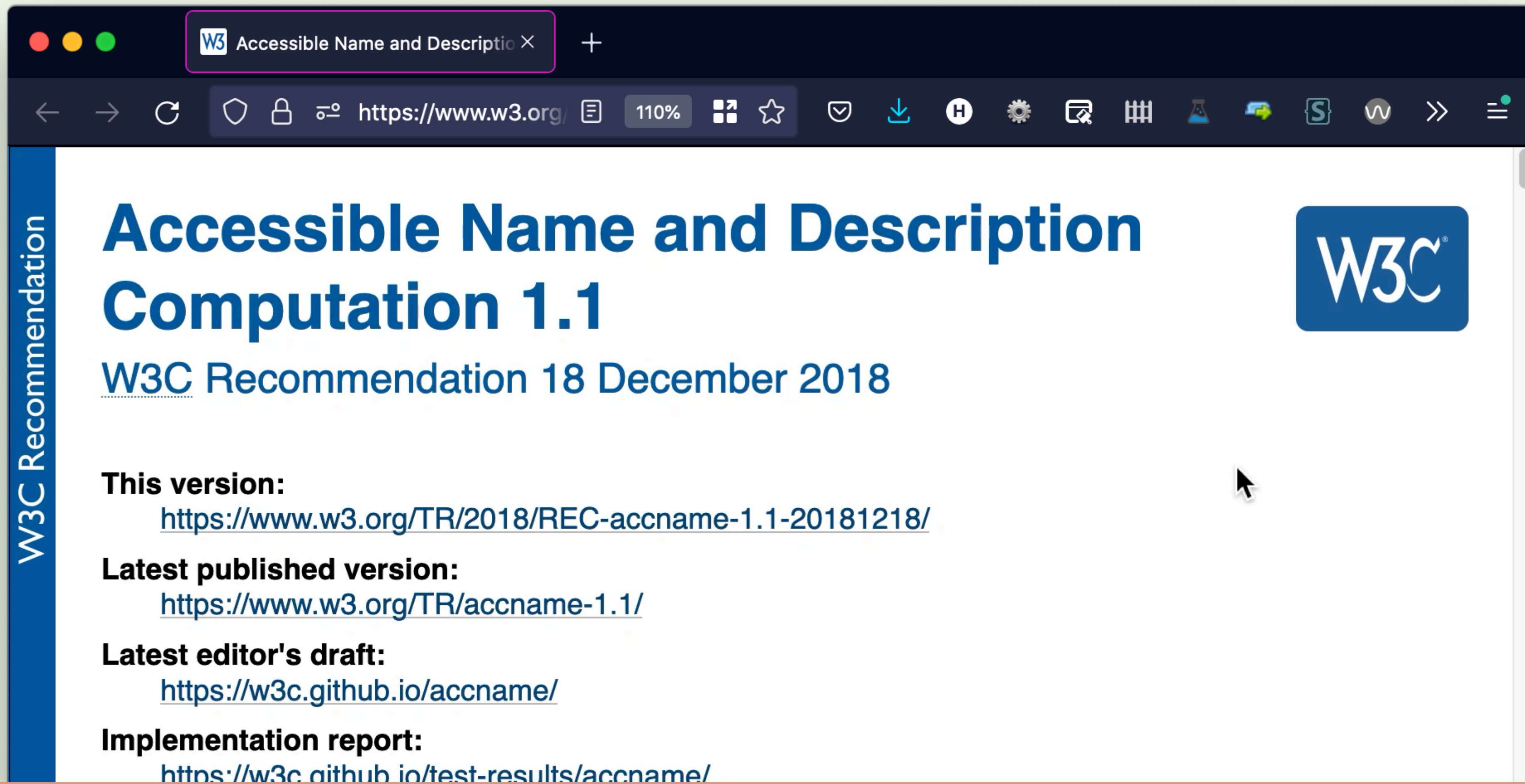
# ::before / ::after is included in accessible name calculation

```
<button>Buy product</button>
```

```
button::before {  
  content: "💰";  
}
```



::before / ::after is included in accessible name calculation



A screenshot of a web browser displaying the W3C page for "Accessible Name and Description Computation 1.1". The browser's address bar shows the URL "https://www.w3.org/". The page features a blue header with the title "Accessible Name and Description Computation 1.1" and the W3C logo. Below the title, it states "W3C Recommendation 18 December 2018". A vertical blue sidebar on the left contains the text "W3C Recommendation". The main content area lists four links: "This version:", "Latest published version:", "Latest editor's draft:", and "Implementation report:", each followed by a URL. A mouse cursor is visible over the page.

W3C Accessible Name and Description ×

https://www.w3.org/ 110%

# Accessible Name and Description Computation 1.1

W3C Recommendation 18 December 2018

**This version:**  
<https://www.w3.org/TR/2018/REC-accname-1.1-20181218/>

**Latest published version:**  
<https://www.w3.org/TR/accname-1.1/>

**Latest editor's draft:**  
<https://w3c.github.io/accname/>

**Implementation report:**  
<https://w3c.github.io/test-results/accname/>



# The future

Our design systems  
commonly contain things that  
are not built into HTML

Sometimes, our design systems  
contain things that do exist, but not  
with our desired level of **style-ability**



“

We hope to make it unnecessary to  
reinvent built-in UI controls

Open UI Homepage, <https://open-ui.org>



**Open UI**

# Goals of OpenUI

Document  
component names  
as they exist today

A common language  
for describing UIs  
and design systems

Browser standards  
for web app  
components

# Goals of OpenUI

Document  
component names  
as they exist today

A common language  
for describing UIs  
and design systems

Browser standards  
for web app  
components



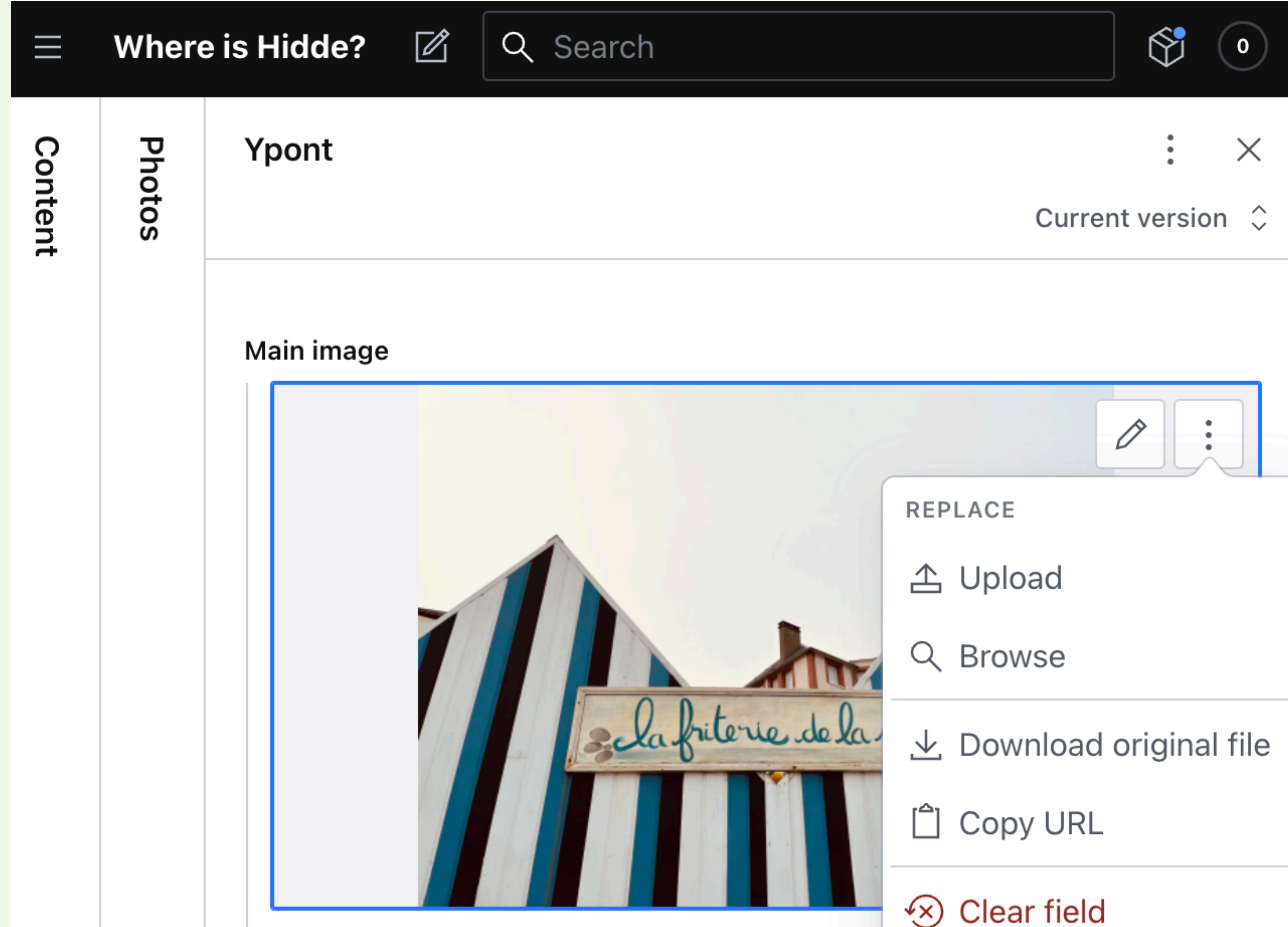
# Goals of OpenUI

Document  
component names  
as they exist today

A common language  
for describing UIs  
and design systems

Browser standards  
for web app  
components

popup would  
be an attribute  
for HTML to  
make popup-like  
behaviors easier  
to build



# popup examples

action  
menus

teaching  
UI

content  
pickers

form element  
suggestions

<select>'s  
listbox



## Common behaviours

on top of  
other page  
content

only open  
when it  
needs to be

usually  
one at  
the time

```
// create a popup
```

```
<div>
```

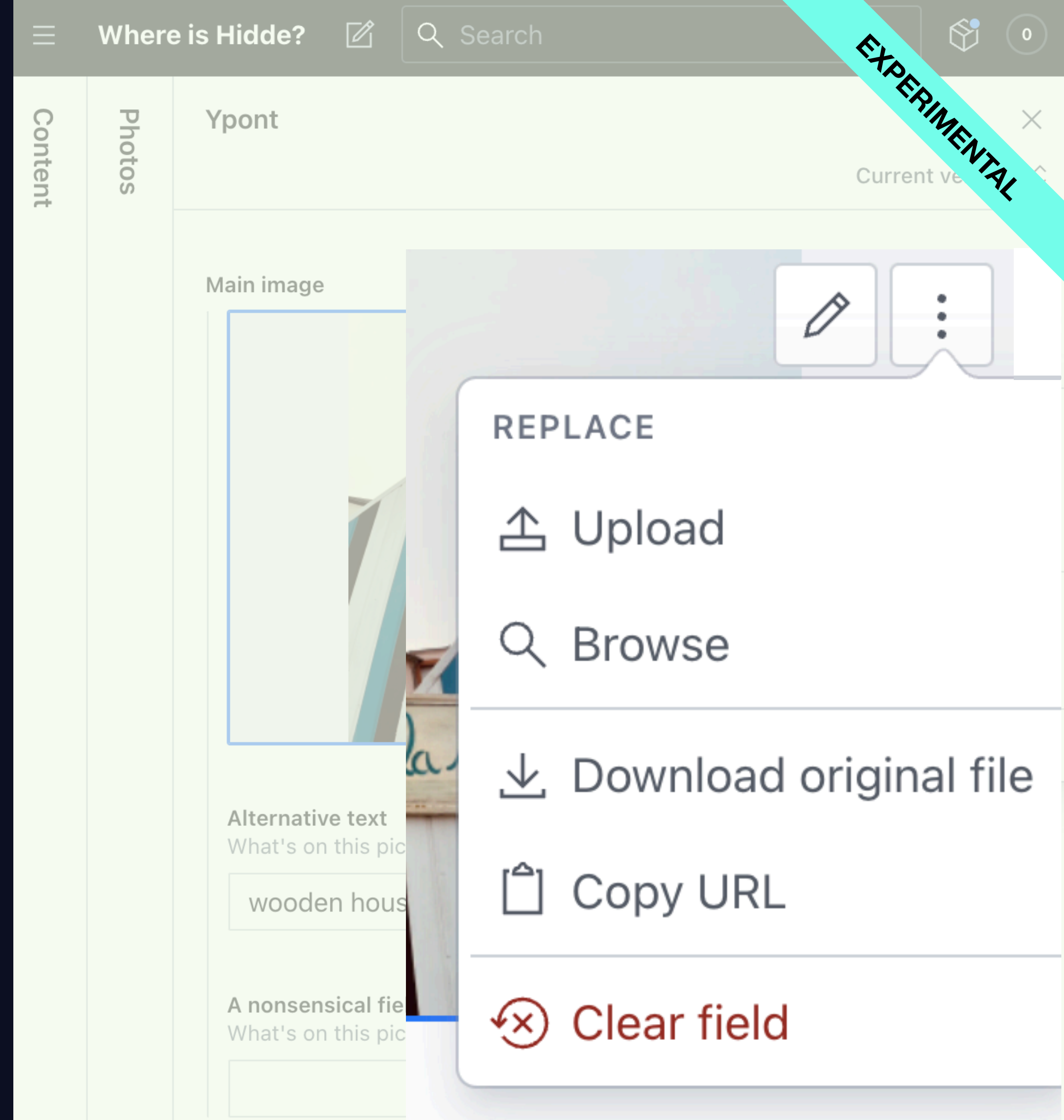
```
  <h3>Replace image</h3>
```

```
  <button>Upload</button>
```

```
  <button>Browse</button>
```

```
  ...
```

```
</div>
```



// give this popup behavior

```
<div popup>
```

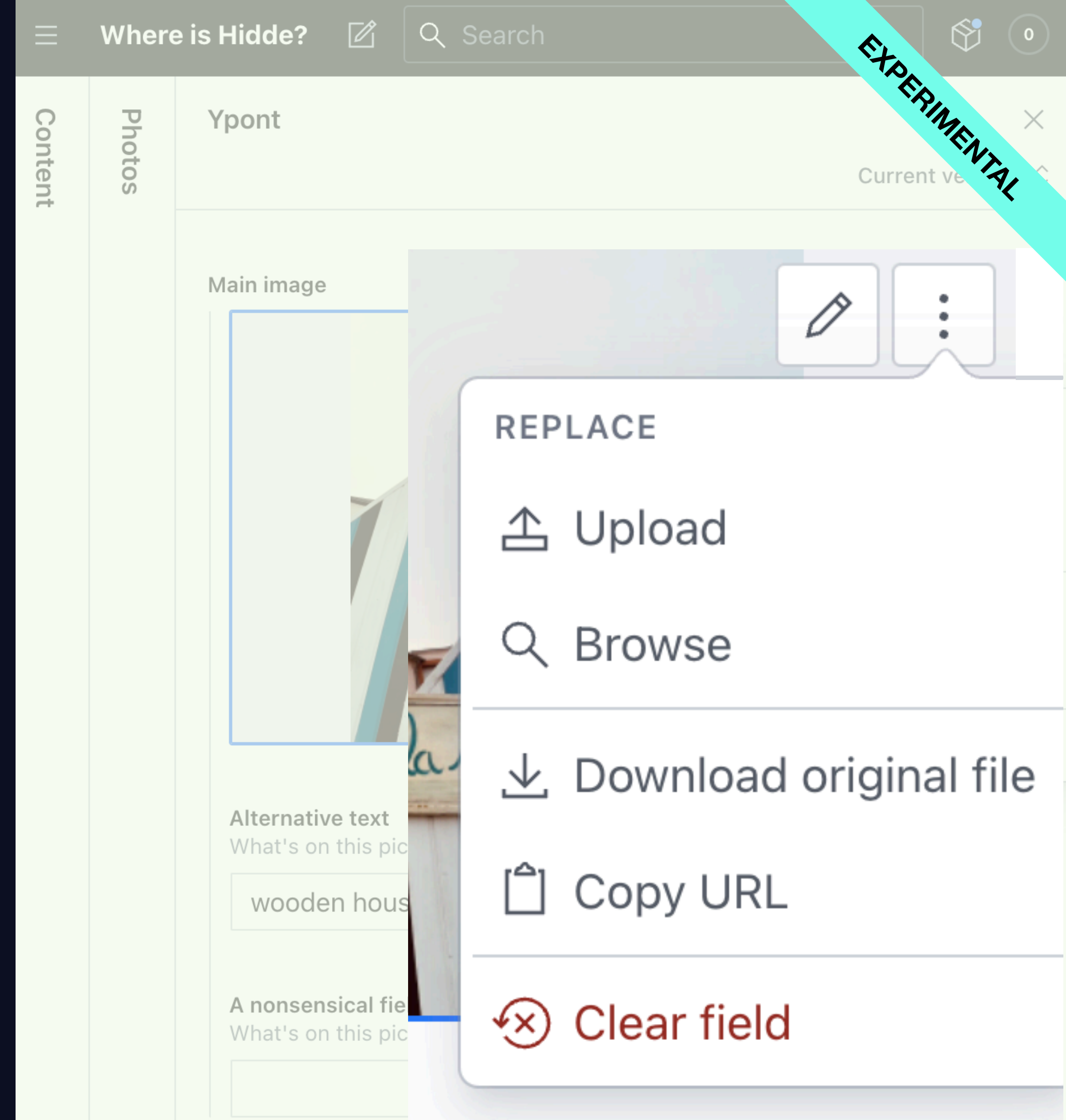
```
  <h3>Replace image</h3>
```

```
  <button>Upload</button>
```

```
  <button>Browse</button>
```

```
  ...
```

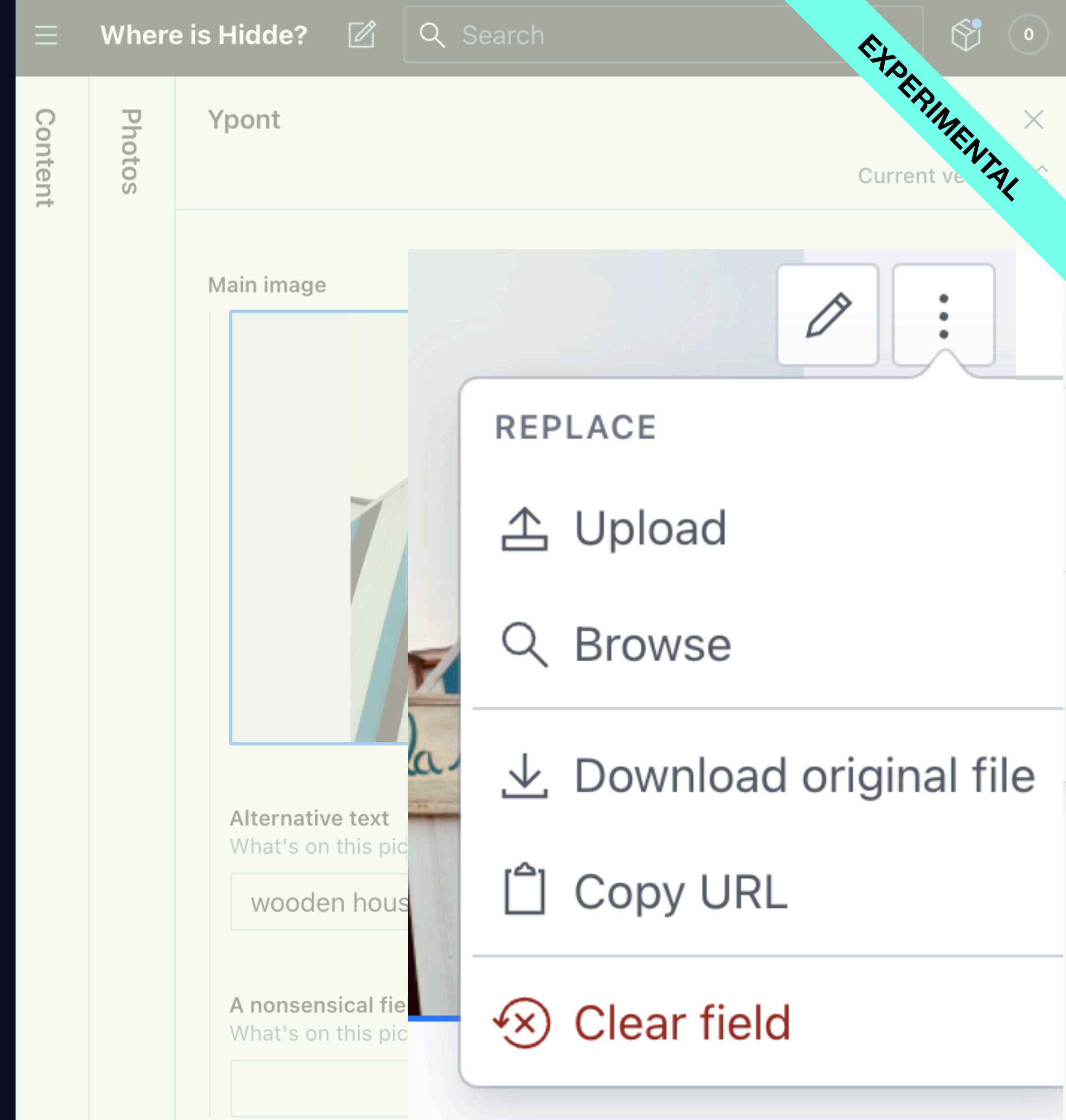
```
</div>
```





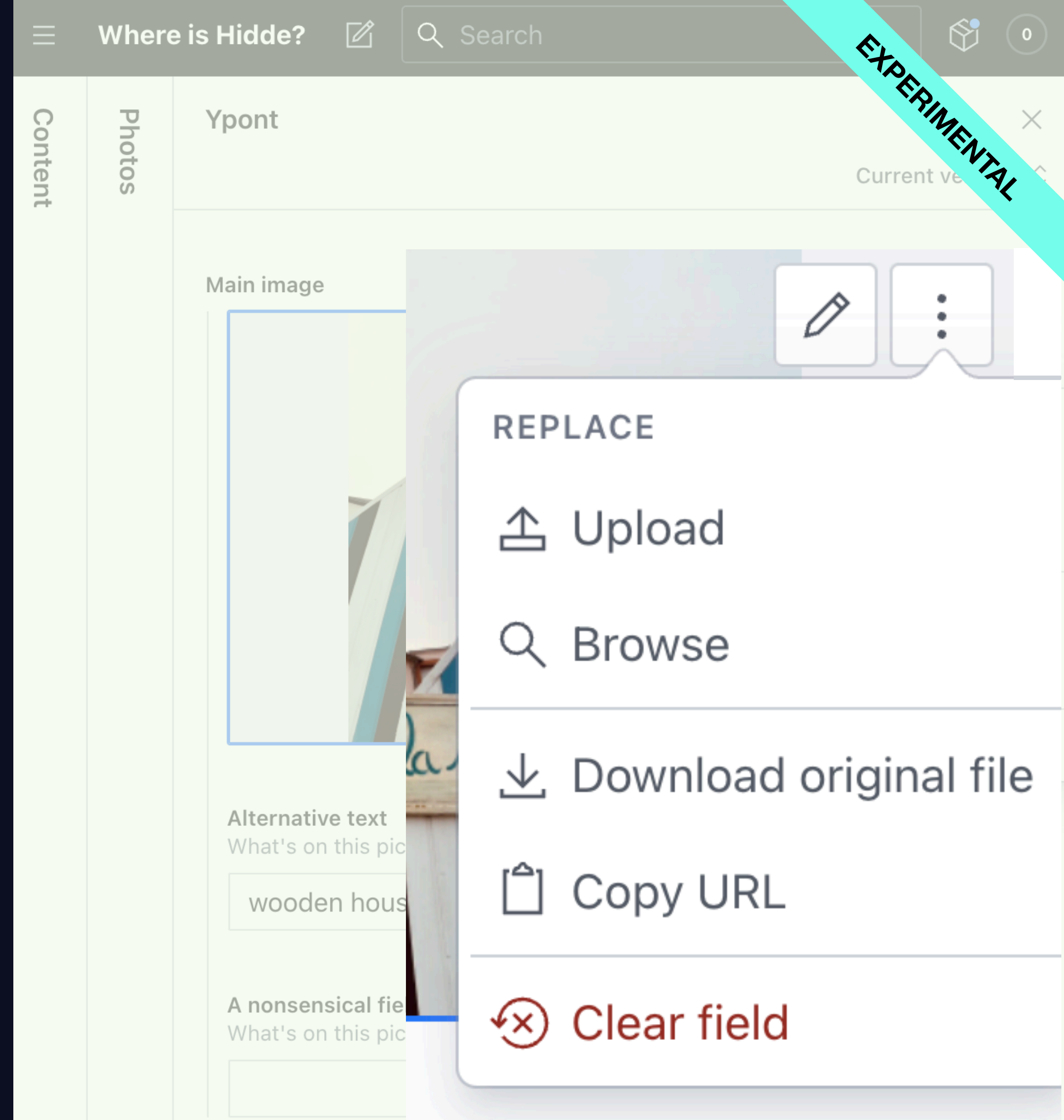
```
// add a unique ID
```

```
<div popup id="options">  
  <h3>Replace image</h3>  
  <button>Upload</button>  
  <button>Browse</button>  
  ...  
</div>
```



```
// add a toggle button
<button popuptoggletarget="options">
  Image options
</button>

// give this popup behavior
<div popup id="options">
  <h3>Replace image</h3>
  <button>Upload</button>
  <button>Browse</button>
  ...
</div>
```



```
// make an async popup
```

```
<div popup="async" id="statusMessage">
```

```
</div>
```



#### Alternative text

What's on this picture?

wooden houses painted lightblue, darkblue and white, with a sign

#### A nonsensical field for fun

What's on this picture?

ad

#### Title

Titles should be catchy-ish, descriptive, and not too long

Ypont


The document was published





```
// make an async popup
<div popup="async" id="statusMessage">
</div>
```

```
const statusMessage =
  document.querySelector("#options");
```



EXPERIMENTAL

**Alternative text**  
What's on this picture?

wooden houses painted lightblue, darkblue and white, with a sign

**A nonsensical field for fun**  
What's on this picture?

ad

**Title**  
Titles should be catchy-ish, descriptive, and not too long

Ypont

The document was published

```
// make an async popup  
<div popup="async" id="statusMessage">  
</div>
```

```
const statusMessage =  
  document.querySelector("#options");
```

```
// do publishing magic, then:  
statusMessage.textContent =  
  "This document was published";  
statusMessage.showPopup();
```



Alternative text

What's on this picture?

wooden houses painted lightblue, darkblue and white, with a sign

A nonsensical field for fun

What's on this picture?

ad

Title

Titles should be catchy-ish, descriptive, and not too long

Ypont

The document was published



# Browser support



Experimental, behind flags,  
known accessibility issues  
about:flags, “Experimental Web Features”



# Conclusion

Semantics only works if shared (use the HTML standard)

Semantic HTML has many benefits, some unexpected

Beware of how CSS, ARIA and AT can impact semantics



# Thanks for listening!

[hidde@hiddedevries.nl](mailto:hidde@hiddedevries.nl)

[hidde.blog](https://hidde.blog)

[Links on talks.hiddedevries.nl](https://talks.hiddedevries.nl)